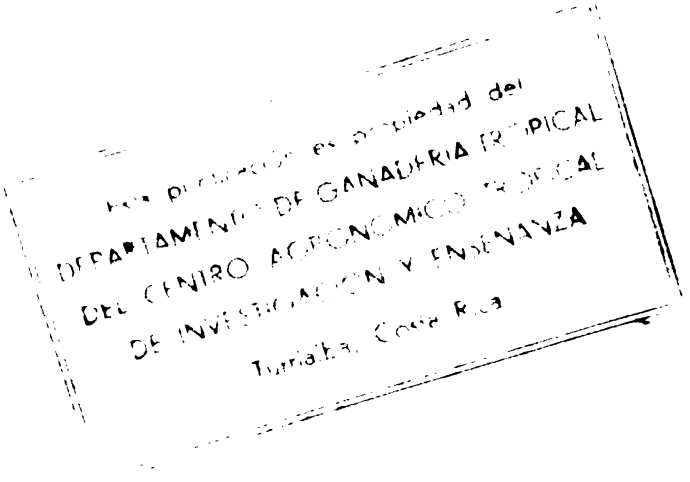
Tropical Agricultural Research and Training Center
(CATIE)
Department of Tropical Animal Production
Turrialba, Costa Rica

MILK AND BEEF PRODUCTION SYSTEMS FOR THE SMALL FARMER USING CROP DERIVATIVES

A Research Project
Submitted for the consideration of the
International Development Research Centre
(IDRC)



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SUMMARY

The research Project presented herein represents a new approach towards the study, development and application of animal production systems suitable for the small and the intermediate farmers of Central America. The Project is of capital importance since no real effort has been made in the past to produce information that will allow the use of crop residues and small farm conditions to develop efficient milk and beef production systems.

The Project consists of an initial survey of small farms to identify currently used agricultural systems. This is followed by dynamic surveys on selected farms in Costa Rica to study the changes in the system's components throughout the year with special emphasis on the animal components.

As a result, well oriented research efforts will be conducted both at CATIE's headquarters and selected farms where emphasis will be placed on the utilization of crop residues, and by-products for milk production.

A final component in this Project is the transference of information both to the small farmers selected in Costa Rica and to national institutions concerned with the improvement of the socio-economic conditions of the rural sector.

The total financial aid requested from IDRC amounts to US$437.500 distributed throughout a period of three years. This aid will include the hiring of an economist,two research

assistants and four surveyors for the first year. The second and third year will only include the economist and research assistants and the necessary operational support. CATIE's [illegible] contribution to this Project has been assessed at US$755.500.

I. BACKGROUND INFORMATION

1. THE INSTITUTION

The Tropical Agricultural Research and Training Center CATIE is an international organism contituted as a Civil Association, under Agreement between the Government of Costa Rica and the Inter-American Institute of Agricultural Sciences of the Organization of American States (IICA). This Agreement was ratified by Law No. 5201, published in the official Costa Rican newspaper La Gaceta on June 1st, 1973.

The maximum authority of CATIE is constituted by a Board of Directors comprised of two representatives of IICA, two representatives of the Costa Rican Government, the Rector of the University of Costa Rica and four ad hoc elected representatives, selected on the basis of their experience and knowledge of the area.

The objective of CATIE is to provide technical support to the Central American and Caribbean countries in their agricultural development programs aimed at increasing food production and the income of the rural people. This support is offered through CATIE's basic programs: Research, Training and Technical Cooperation. All three Programs are designed for the study of existing agricultural production systems, the development of better production systems and the aplication of the improved technology to the small and medium-size farm.

CATIE's basic programs are financed by IICA, the Governments of Costa Rica, Panamá, the Netherlands, and West Germany, and through Contracts with ROCAP-AID. In addition, a modest income is obtained from the coffee, sugar cane and cattle experiment farms.

The 1100 ha land granted to CATIE is located in the lowlands of the Atlantic slope of Costa Rica, with main headquarters in Turrialba where basic facilities have been created for research and training. These include laboratories, classrooms, greenhouses, herbaria, housing facilities for the staff, guests and students, restaurant, experiment farms for cattle, crops, and forestry. An Electronic Computation Center and an excellent Library, both property of IICA, are located at CATIE and well utilized by the Center's Research and Graduate Training Programs.

2. THE DEPARTMENT OF TROPICAL ANIMAL PRODUCTION

CATIE is organized in three Departments: Tropical Crops and Soils, Natural Resources and Tropical Animal Production. The latter will have the responsability of carrying out this Project.

The Department of Tropical Animal Production has a staff of five highly qualified professionals, all with Ph.D.degrees and at least five years of experience in both research and graduate training at Turrialba, and other parts of Costa Rica, Panamá and Mexico. In addition to office,

laboratory and classroom facilities, a 400-ha experiment farm is intensively used for research and commercial purposes. The 800-head cattle population is mostly destined for dairy and/or beef production research.

Research at CATIE in animal production has been aimed at the development of milk and beef production systems. This effort has been based on the efficient utilization of grasses, the most abundant feed resource in tropical countries, and agricultural by-products and wastes which have been studied mainly as complements of grasses when these have declined in production or quality. As a result of several years of work with this philosophy, very important technology has been created and it is now possible to design a number of production systems which predict large increases in milk and beef production to levels comparative to those obtained in temperate zones. Some of these systems have been verified at the commercial level. Nevertheless, the results have favored mostly the intermediate and large property owner, although the results can also be of some value for small farmers.

In view of the situation outlined above, and considering that research carried out elsewhere in the tropics is largely of traditional approach (which tends to favor the large cattle owner), It is important to start work clearly oriented towards helping the small farmer. Some of the results will also be of benefit to the intermediate property owner. This change in focus forms the basis for this Project.

Obviously, this Project will give emphasis to the animal component, especially to the species of cattle destined primarily to the production of milk. The main reasons for this emphasis are:

a. The majority or all (depending on the farm) of the potential nutritional resources for animals are fibrous in nature and very poor in protein. Of all domestic species, the ruminant is most capable of utilizing fiber and of accepting non-protein supplementary nitrogen sources, which it converts to protein of high quality for human consumption.

b. Eighty percent of the small and medium-sized farms of Costa Rica contain cattle and half of the total bovine population of Costa Rica is in the hands of the small and intermediate farmer.

c. The small and the intermediate farmer usually obtains milk from his cows, even though they usually are primarily beef-type cattle. The milk is a product which is usually consumed on the farm where it is produced and, therefore, may best be used for the direct improvement of the nutritional situation of the rural families.

d. The dominant policy of the Central American Governments is the promotion of milk production.

Since information on how to utilize crop residues as a basis for feeding systems on small farmers is lacking, this Project is not only a novel approach but also of

utmost importance for the improvement of the social and economic condition of the small farmer by means of more efficient utilization of existing resources. It is expected that a large proportion of the information will be derived from or generated by the farmer himself and that national institutions will cooperate with the project through agreements already established.

II. OBJECTIVES

1. GENERAL

   a. To study current traditional production systems and to develop and verify integrated crop-animal production systems for small and intermediate farmer of Central America. These improved systems will quantitatively relate the optimum production of crops and animals to the combination of plant species, type of animal, type of livestock production, class of soil, farming and management practices and level of education.

   b. To effectively contribute to the creation of an integrated and multidisciplinaty action directed to the development of the rural area, i.e., towards the socio-economic improvement of the small farmer and an efficient utilization of the agronomic, animal and economic resources.

2. SPECIFIC

   a. To carry out a diagnosis of the small and intermediate farms in Central America in order to identify the present systems.

   b. To develop adequate technology which will allow an increase in milk and beef production through a more efficient use by the animal of crop products, by-products and wastes.

   c. To train technical personnel in the region at the level of Master of Science or through in-service training for

short periods of time, within the context of integrated agricultural systems for the small farmer.

d. To carry out the initial phase of transferring production systems technology to the small farmer using selected receptors in Costa Rica, which must be representative of the small farmers of Central America.

III. METHODOLOGY

In a sequential manner, the main mechanical components of the Project will be as follows.

1. DIAGNOSIS

Through a single initial survey it is intended to identify the predominant agricultural production systems currently used by the small and intermediate farmers in Central America. This may be called a static diagnosis.

In addition a dynamic diagnosis will be carried out on approximately 40 Costa Rican farms distributed in four different ecological zones. The criteria for selection will be as follows:

a. Farm size.

b. Existence of the animal component in the farming system.

c. Similarity of conditions to those found predominant in small farms elsewhere in Central America, taking into account the first diagnosis, agricultura census data, rural development studies, ecological studies and characterization data resulting from the survey conducted by CATIE's Project on Cropping Systems in various Central American areas with a predominance of small farmers.

c. Closeness to road networks.

e. Localization in areas with high concentration of small and medium-size farms.

The diagnosis will be characterized by being carried out over a period of at least one year by a team of four assistants, directed by an economist. There will be weekly visits during which the professional people will not only solicit information, but also will participate in the activities of the farm in order to gain the confidence of the farmer and to gain additional information that may not have been considered in the diagnostic scheme. This relationship with the farmer will also be of benefit in the phase of transfer of technology.

As a result, the diagnosis will not be carried out by means of a single questionaire at a specific time, which could give an erroneous image of the farm situation, but will be realized in the form of a dynamic evaluation of the flow of the agricultural components: plants and animals.

The reason for conducting a dynamic diagnosis is to discover what actually exists on the small and medium-sized farm as the crops, animals, and labor change or occur in certain sequential order throughout the year. Only with this type of information will it be possible to effectively design the search for solutions to the problems of the farmer.

The data obtained from the evaluation will refer to the types of crops, the volume and distribution of their by-products and wastes, type of animal(s), levels of

production, variations in prduction during the year and the level of commercialization of the products. In addition, other data of a socio-economic and physical (soils, topography, etc.) nature would be collected. The precise image resulting from the diagnosis will serve not only as an aid to planning with more certainty the activities of investigation but also as a point of reference against which to measure the level of progress achieved by the producer, and by the technical assistance program resulting from this Project.

2. RESEARCH

Parallel to and based on the information obtained from the diagnoses, two general types of research will be conducted.

a. Literature

Data will be compiled pertinent to the utilization, by the animal, of the existing resources on the farms studied or pertinent to the wastes and derivatives which would result from other crops which could feasibly be adopted by the farmers.

b. Generation of new information.

Research will be carried out on aspects on which there is no literature or on which the existing data are insufficient or if it is not feasible to integrate such information into systems of production.

Since CATIE already has a direct general knowledge of the agricultural situation in Central America, it is possible that during the first year of the project research activities could be initiated along with the diagnostic activities. This research would use as basic materials, (in addition to grasses) the derivatives of corn, beans, rice, cassava, and sweet potato, all traditional crops of the small farmer. As the dynamic diagnostic information is produced and as the information from the Crop Production Systems Program of CATIE is integrated into this Project, the research activities will be more and more centered around the dynamic reality of the small farm.

The production of information will include:

i) The study of the chemical composition and digestibility of the nutrients derived from the crops. This information will be qualitative.

ii) Experiments on the utilization of the crop derivatives in animal production in conjunction with grasses where these are present on the farm. The objective of these experiments will be to quantify the factors which affect the animal response. This implies that production indices will be developed and the variation of those indices will be quantified, as they are affected

by: (1) the factors which regulate the consumption of each material; (2) the factors which affect the digestibility of the materials; (3) the variation in the sequence and intensity of the cultivation throughout the year; (4) the type of animal production (production of beef, milk or both products), etc.

iii) The economic evaluation of the results at the experimental level will be one important characteristic of this investigation.

By the use of economi· analysis it will be possible to discard certain strategies and lines of investigation and identify and emphasize the conditions which lead to bioeconomic optimization.

iv) Integration of the information produced by this Project with the information previously existing resulting in the proposal of systems for the small and intermediate farmer. The adaptation and validation of these systems on selected farms which present varied conditions (ecology, for example) is a part of the final phase. For example, a small farmer who currently dedicates part of the year to migrant work, such as the picking of coffee beans, leaves his own farm abandoned in the sense of production for that period of the year. If, as a result of this Project, a system is developed

which demands the farmer's attention throughout the year, such a system not only must be more productive than the one to which he is accustomed, but also must easily accepted and adopted.

The integration of information will include not only the integration of aspects of animal production, but also integration with information provided by the Crop Production Systems Program of CATIE (crop sequences, yields, efficiency) and the resulting improved agronomic practices. The inclusion of these agronomic practices with the animal component may require additional changes in the sequence of crops, in the selection of species and in the intensity of the cultivation.

The data and the experience acquired during research and technical assistance cooperation programs carried out by the Department of Tropical Animal Production in Costa Rica, Honduras and Panama will also be utilized and integrated into the Project.

c. Transference of technology

This is a key component, of the total action involved, although not the most important part of the Project due to the time and economic support which it requires. Moreover, a program with impact for the transfer of technology must have, first, a technology adequate to the solution of production problems inherent in the

tropics and in the small and medium-size farms. Therefore, a considerable amount of effort in this Project will be directed towards the creation and adaptation of technology. For the purposes established in this Project, technology transference will be carried out only at the level outlined in item (iv) under the heading "Research", page 12, that is to say, that as a result of research on adaptation or validation of systems to farm conditions, there will be in effect a transfer of technology. In this aspect of the Project, local extension agents and credit program technical experts will be involved. In addition, the farmer himself will play a significant role in the process of providing technical assistance since he will participate in the decision-making processes and will absorb transference knowledge. As such, the farmer and his farm will become effective means for the divulgation of technology packages to his community.

In addition to the specific action described in the previous paragraph, technology transfer will include the training of local personnel at the level of Magister Scientiae (two scholarships per year) and the disclosure of experiences and formal knowledge through a seminar planned for the third year of operation of this Project.

Other means such as field days and bulletins will

also be used.

Finally, existing links between CATIE and national institutions will be utilized to transfer practical technology and academic knowledge to the technicians and in the process to motivate such institutions to gradually join the Project or to eventually take full responsability in the development and application of production systems for the small farmer.

IV. BUDGET

The budget requested from IDRC is shown in Table 1. The budget provided by CATIE is explained in Table 2.

1. PERSONNEL REQUIRED

The additional professional staff needed for the execution of this Project consists of one economist at the Ph.D. level, two research assistants at the M.S. level and four lower level technicians. The economist would be classified as international staff member and will evaluate the systems actually used by the farmers and participate in the development and selection of the most efficient production systems. The mass of data that will be compiled covering all the required production inputs,and socio-economic aspects, will permit pertinent economic analyses to be made prior to making recommendations to the farmers of any particular system. At the present time, CATIE does not have an economist working in the area of animal production.

The experts at the M.S. level (nationals) will be needed to provide assistance in research conducted at Turrialba and on farms, and to help in the guidance for Graduate Students conducting research for this Project.

The technicians at the lower level will be required for the surveys and continuos diagnosis of farm situations. These technicians will be working directly with the economist and one will be located at each of the four action

areas selected in Costa Rica.

2. OPERATIONAL COSTS

In order to conduct the quantitative and qualitative evaluation of the by-products at CATIE, as well as for the work with animal production,operational expenses is required for labor and feed for the cattle. The funding for animal feeds will be treated as a rotating fund (one time only), since this item will produce income as a result of the weight gain of the animals and of the sale of some of the crop products. In addition to these items, economic aid is required for field equipment,laboratory materials and computer costs for the evaluation of the results.

3. TRAVEL

Economic aid is required for local travel and per diem expenses by the personnel gathering farm information,doing research at farms or national experiment stations.

4. TRAINING

Four Graduate Students may be involved with this Project by means of their work, therefore needing four scholarships with a maximum duration of two years per scholarship. IDRC help is also needed for the organization of a workshop in the third year of activities for the purpose of training and capacitating national profesional people to undertake or continue Project activities within their own institutions.

5. PUBLICATIONS AND MEETINGS

Funds would be needed for the publication of brochures

and pamphlets describing the objectives and significance of the Project. These would be distributed to the national institutions and the technical community in the area. Also, a technical meeting would be held at the end of the third year in order to inform about the results and progress obtained.

6. CONSULTORS

Short term consultancy by a specialist in production systems with emphasis on small farmers would be needed. This consultancy would serve to exchange and discuss ideas and plans with the Project personnel.

7. CAPITAL COSTS

The personnel in charge of information gathering at the farm level will require a "jeep" and four sturdy motorcycles to get around rough country roads and paths.

8. "OVERHEAD"

CATIE has a policy of charging administrative and service expenses to each project established in support of research activities.

TABLE 1
Proposed Budget
IDRC CONTRIBUTION

	Years 1	2	3	TOTAL
OPERATIONAL BUDGET				
Salaries and Allowances				
Economist	16.1 (1/2)	34.2 (1)	36.0 (1)	86.3
Research Assistant	24.0 (2)	25.4 (2)	27.0 (2)	76.4
Technicians	8.0 (2)	17.0 (4)	-	25.0
Subtotal	48.1	76.6	63.0	187.7
Research Expenses				
Casual Labor	5.2 (4)	11.0 (7)	11.7 (7)	27.9
Feeds (Rotatory Fund)	30.0	-	-	30.0
Field Equipment	3.0	3.0	3.0	9.0
Laboratory Supplies	3.0	1.5	1.5	6.0
Computer Services	4.0	6.0	4.0	14.0
Operation and Mainten. Vehicles	1.5	3.0	3.0	7.5
Subtotal	46.7	24.5	23.2	94.4
Travels				
International and Local	2.0	5.0	4.0	11.0
Subtotal	2.0	5.0	4.0	11.0
Training				
M.Sc.	6.5 (1)	19.5 (2)	26.0 (2)	52.0
Short Courses	-	-	10.0	10.0
Subtotal	6.5	19.5	36.0	62.0
Publications and Workshop				
Publications	-	1.5	-	1.5
Seminars	-	-	12.0	12.0
Subtotal	-	1.5	12.0	13.5
Consultancies				
Consultors	2.0	2.0	-	4.0
Subtotal	2.0	2.0	-	4.0
Contingencies				
TOTAL	105.3	129.1	138.2	372.6
	OVERHEAD			
Operational (15%)	15.8	19.4	20.7	55.9

	Years 1	2	3	TOTAL
	CAPITAL BUDGET			
Vehicle (1)	5.0	-	-	5.0
Motorcycles (4)	4.0	-	-	4.0
Subtotal	9.0	-	-	9.0
TOTAL	130.1	148.5	158.9	437.5
	BUDGET SUMMARY			
Operational	105.3	129.1	138.2	372.6
Overhead on Operational (15%)	15.8	19.4	20.7	55.9
Capital	9.0	-	-	9.0
TOTAL	130.1	148.5	158.9	437.5

TABLE 2

PROPOSED CATIE CONTRIBUTION

(Department of Tropical Animal Production Budget)

	Years 1	2	3	TOTAL
Salaries and Allowances				
Animal Production Specialist(s)	139.9	146.9	154.2	441.0
Auxiliar Personnel	20.7	21.8	22.9	65.4
Subtotal	160.6	168.7	177.1	506.4
Research Expenses				
Casual Labor (15)	19.5	20.5	19.5	59.5
Feeds (Rotat.	37.0	-	-	37.0
Field Equipment	4.0	4.0	4.0	12.0
Laboratory Supplies	5.2	4.0	4.0	13.2
Computer Services	1.9	2.5	2.5	6.9
Oper. and Mainten.Vehicl.	4.4	3.2	3.2	10.8
Subtotal	72.0	34.2	33.2	139.4
Travels				
International and Local Travels	2.9	3.0	3.5	9.4
Subtotal	2.9	3.0	3.5	9.4
Training				
M.Sc.	Fellowships			
Publications and Workshops				
Publications	0.3	0.6	0.8	1.7
Seminars	-	-	-	-
Subtotal	0.3	0.6	0.8	1.7
Consultancies				
TOTAL	235.8	206.5	214.6	656.9
Overhead				
Operational (15%)	35.4	31.0	32.2	98.6
GRAND TOTAL	271.2	237.5	246.8	755.5